Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-121-AC2, 2020

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "On tuning of atmospheric inverse methods: Comparison on ETEX and Chernobyl datasets using FLEXPART v8.1 and v10.3" *by* Ondřej Tichý et al.

Ondřej Tichý et al.

otichy@utia.cas.cz

Received and published: 1 October 2020

We would like to thank you for providing us with review of our manuscript. We are glad that we can submit a revision of our paper. In the following text, we will respond to all comments.

The paper "On tuning of atmospheric inverse methods: Comparison on ETEX and Chernobyl datasets using FLEXPART v8.1 and v10.3" addresses a very important aspect of emergency management, the reconstruction of the mostly unknown source term. It discusses in detail the importance of prior knowledge which is often very small in real situation.

Printer-friendly version

Discussion paper

→ The paper discusses tuning approaches of some of the key parameters. This is discussed in the main part of the paper, however, more from a theoretical perspective. The paper would gain from a discussion on the application for a novel source term that has no a priory knowledge. Which steps should be performed to optimise the parameters for the reconstruction of the source terms?

***Authors response*:** Existing methods of source term estimation are based on omitting linear terms in optimization criterion J (considering the model of deviation of the SRS matrix as $\mathbf{M}_{true} = (\mathbf{M} + \Delta_{\mathbf{M}})$). Since the knowledge on $\Delta_{\mathbf{M}}$ is always insufficient, it seems to be a reasonable option. The regularization terms has to be used to improve conditioning of the linear inverse problem. Tuning the penalizations is often done manually without reporting alternative solutions. One of our main recommendations is to perform cross-validation to determine agreement of the chosen regularization with the data.

Second recommendation is for future development, in which we propose to use additional information, such as sensitivity of the concentration field around the sensors, to design new regularization terms that would to compensate the deviation $\Delta_{\mathbf{M}}$.

***Changes made in the paper*:** We extended discussion in the Conclusion section accordingly.

Otherwise, the paper is very informative and does not require modification in structure and style.

→ The authors may also briefly discuss the difference between version 8.1 and 10.3 and to which extend the same functionality is available in the newest version 10.4

***Authors response*:** Recent updates added new functionality in FLEXPART such as the possibility to run the model for skewed convective conditions, to run the model backward from deposition values, or parallelization. However, for the applications presented here, no important changes were made between v8.1 and v10.3, such that results of both versions can be expected to be equivalent.
The main focus of the paper is analysis of sensitivity of inversion methods to choices such as the prior source term or tuning parameters. We have not intended to compare versions of the FLEXPART. We realize that the previous title of the paper could be confusing since it mentioned both FLEXPART versions used in the paper and it might be understand as the comparison between FLEXPART versions. Therefore, we changed the title slightly after consultation with the editor.

***Changes made in the paper*:** We change the title of the paper slightly to avoid the misunderstanding about the comparison between FLEXPART versions. Now it reads "On tuning of atmospheric inverse methods: Comparisons on ETEX and Chernobyl datasets using the atmospheric transport model FLEXPART".

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-121, 2020.

Printer-friendly version

Discussion paper